FINAL REPORT

Project No. 8-0046

Grant No. OEG-0-8-080046-2670(032)

AURAL STUDY SYSTEMS FOR THE VISUALLY HANDICAPPED

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Louisville, Kentucky 40206

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Department of Health, Education, and Welfare

U. S. Office of Education

Bureau of Education for the Handicapped

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Department of Health, Education, and Welfare

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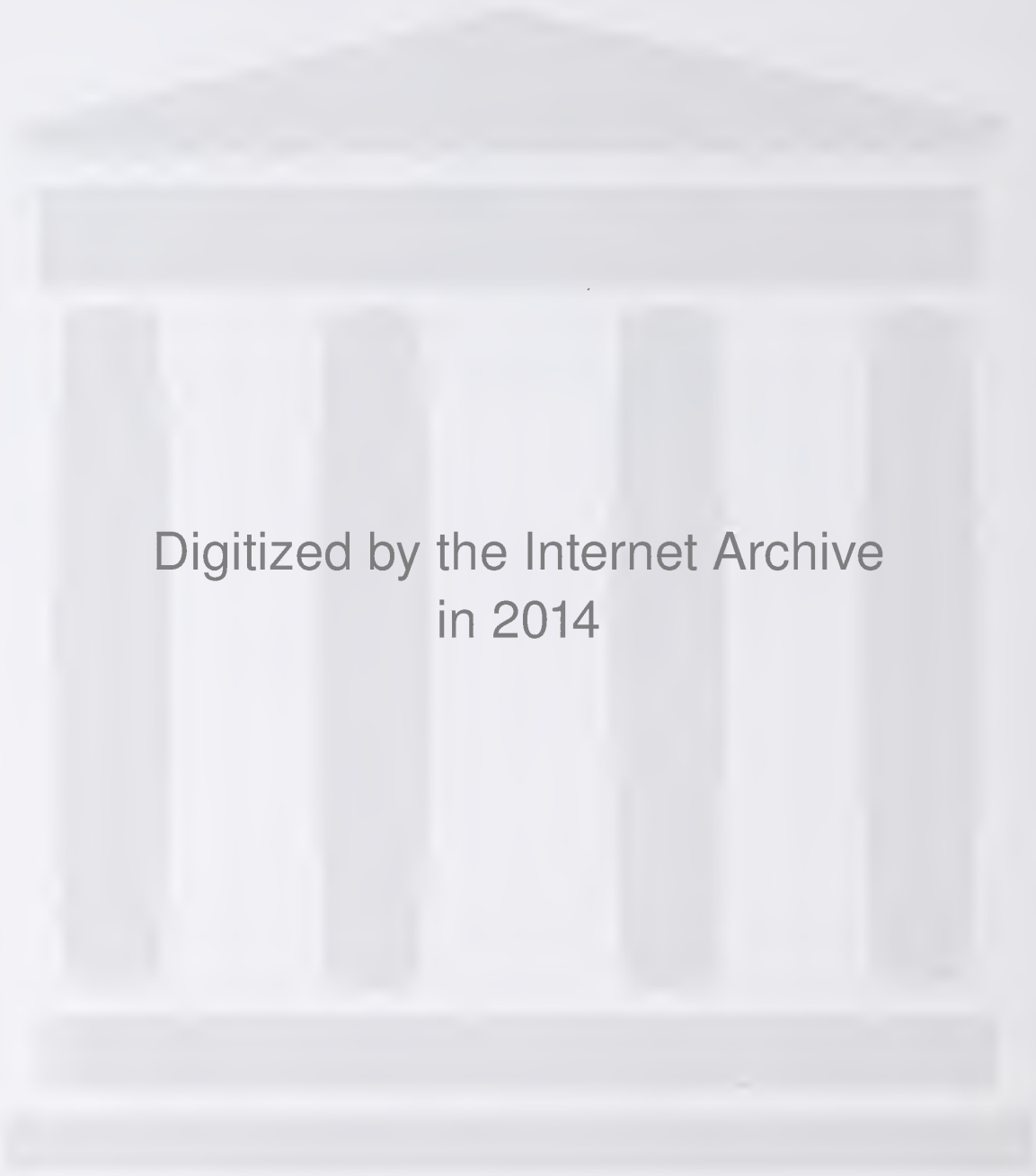

Background for the Project

The Problem

For the education of the blind, two primary communication modes are available, reading and listening. While auditory communication has always played a large informal role in the education of blind children, the schools have emphasized reading in the form of braille and large type books. Unfortunately, reading rates for braille and large type are quite slow. The average blind high school senior reads braille at about 86 words per minute (wpm) (Ethington, 1956), as compared with 251 wpm (Harris, 1970) for his sighted peer. Average reading speed for legally blind large type readers was found to be about 90 wpm (Nolan, 1966). Consequently, completing an assignment takes much longer for the blind student and his slow rate of progress in reading is often held responsible for the frequent educational retardation found among this group.

Greater utilization of auditory communication, where appropriate, would do much to decrease the time needed to cover a study assignment. Recordings made for the blind at the American Printing House normally approximate 175 wpm and recent research (Foulke, Amster, Nolan, & Bixler, 1962) has indicated that the blind can successfully comprehend auditory material presented at 275 wpm. Therefore, widespread provision of text materials in recorded form could be a great advantage.

The Relative Effectiveness of Reading and Listening in Study

Many researchers have compared the relative effectiveness of listening and reading by the normally sighted. Witty and Sizemore (1959) have published an extensive review of this research. General findings are that listening results in superior comprehension for children in the elementary grades and at low MA levels while reading results in superior comprehension in the secondary grades and at higher MA levels. Analysis of the results of these studies by the authors of this report indicates that the relative superiority of listening and normal reading may be contingent upon reading rate. That is, when listening rates exceed reading rates the former results in superior comprehension. However, when reading rates exceed listening rates, then reading results in superior comprehension. The comparative usefulness of reading and listening has been found to vary with a number of factors including intelligence, reading ability, difficulty of material, length of material, and familiarity of material.

Comparative studies of reading and listening comprehension of the visually handicapped have been reported by Nolan (1966). He conducted six studies comparing comprehension of materials from literature, social studies, and science. Subjects included groups from both elementary and high schools who read either braille or large type. In general, results were the same for both types of readers. In the elementary grades, listening and reading resulted in equal retention for materials in all three curricular areas. For high school students, no differences in retention were found for science. However, for both literature and social studies, significant but slight differences in retention favored the reading groups.

Efficiency of learning, expressed as the ratio of the mean retention score to the mean time required to read or listen, was clearly superior for the listening groups. In all cases, it took much longer to read than listen to materials. At the high school level, listening proved to be from 183% to 248% more efficient for braille readers and from 154% to 207% for large type readers. At the elementary level, similar ranges were 284% to 360% for braille and 190% to 254% for large type readers.

Some Factors Affecting Listening Comprehension

The factors affecting listening comprehension appear quite similar for the normally sighted and the visually handicapped. Some of these are briefly described below as being related to materials characteristics, listener characteristics, or behavioral factors.

Materials characteristics. The measured level of difficulty of material is negatively related to listening comprehension (Carver, 1941; Hampleman, 1958). Length of newscasts has also been shown to be negatively related to comprehension (Harrell, Brown, & Schramm, 1949). Rate of presentation is also a factor in comprehension. Studies of increased rates produced through mechanical speed controls or time compression techniques show that comprehension remains the same through increase in rates to 250-275 wpm after which it diminishes rapidly with further rate increase (Foulke, et al., 1962; McLain, 1962). Materials (players and recordings) currently available for study appear to be incompatible with the objectives and techniques for most efficient study through listening (Nolan, 1966).

Listener characteristics. Among factors found positively related to listening comprehension are intelligence (Hartlage, 1963; Kramar, 1955), grade level (Brown, 1959; Nolan, 1966), and academic achievement (Nolan, 1966).

Martin (1961) reported that children's interest in material and their opinion relative to its difficulty correlated significantly with comprehension scores. Students who read braille were found to have superior listening comprehension to those who read large type (Nolan, 1966).

Behavioral factors. Students who use well organized listening study techniques score highest academically (Carter, 1962). Maintaining attention while listening is a problem for blind students. Interrupting practice prevents drowsiness. Note-taking was reported by students as an activity contributing to attention (Nolan, 1966). Active participation in the listening process through mental review or note-taking contributes to listening comprehension (Gropper & Lumsdaine, 1961; Nolan & Morris, 1969). Frames of reference for listening attained by brief preview of the materials to be heard appear to enhance listening comprehension (Brandes & Shepardson, 1967; Friedman, Orr, & Graae, 1967).

Purpose of the Research Program

In the original research proposal, four goals were identified. These included:

a. To make comparisons of listening and reading in learning with particular emphasis on above normal reading rates in listening and more active participation in the listening experience by students.

b. To make a task analysis of the job of learning through listening.

c. To use the task-analysis information to design and build a system for study using recorded texts that would coordinate design of playback equipment, recorded book formats, and response systems around the goals for efficient study.

d. To evaluate this system through user tests.

In the interval between writing the original proposal and attainment of funding, sufficient research was completed on effects of active participation in listening at compressed rates to diminish the potential for further research in this area. Consequently, this goal was changed "to study and identify behavioral and procedural factors related to efficient study through listening."

Structure of This Project

The work completed under this grant can be divided into two categories; factors related to listening comprehension and development of an aural study system. Research and development under these two categories will be described in turn. Findings from both categories will then be integrated. Suggestions for further research and development will be made.

Factors in Learning through Listening

These studies were all designed to explore research hypotheses about the listening process that stemmed from research previously conducted at the American Printing House or reported in the general literature. The studies include research on effects of manipulations of motivational variables on relative comprehension for material presented at compressed and normal word rates, exploration of the effects in variations in study time and scheduling on listening comprehension, study of the relative effectiveness of listening and reading for children of low ability, exploration of the effects of varying lengths of message on listening comprehension, and study of the effects of attainment of a prior frame of reference on listening comprehension. All studies have been published in full previously as interim progress reports. Consequently they are briefly summarized here.

1. Effects of Motivation and Word Rate on Aural Comprehension (Morris & Nolan, 1970a)

In 1967, research conducted at the American Printing House (Nolan & Morris, 1969) indicated that, under conditions of high motivation, comprehension by blind students for auditory materials presented at normal rates was significantly superior to that presented under even low levels of speech compression. This was contrary to most previous research findings.

The purpose of this study was confirmation of these results. Two groups of blind students, 108 from grades 4-7 and 120 from grades 8-12, listened to literary stories appropriate for their grades. Of the total group, one-third listened to a recording at 175 wpm, one-third at 225 wpm, and one-third at 275 wpm. Half the students listened under motivated

conditions where each had a chance to win two prizes for superior performance. Half the students listened under conditions where no prizes for superior performance were offered. The major result of the study was that levels of motivation, at least as determined by the procedures of this study, had no effect on the relative comprehension for auditory materials presented at regular and compressed rates.

2. Some Parameters of Learning by Listening--Part One--The Effects on Learning of Repeated Continous Listening (Morris & Nolan, 1970c)

From consumer interviews conducted earlier as part of this research program (Morris & Nolan, 1969), it was learned that users of recorded texts who took notes seldom listened to their texts more than once. They felt that review of these notes was sufficient for further study. This aroused curiosity about the usefulness of repeated listening and the curve for learning resulting when students listen to material for two or three consecutive presentations. Therefore, study of this problem was initiated.

Two duplicate experiments required learning literary and science materials through listening. Participating were blind students from grades 9-12 and 4-6. Equal groups of braille and large type readers were included. The primary factor studied was the amount students learned when they listened once and when they listened to two or three consecutive presentations. Results of the analysis of the data were revealing.

For high school students, repeated listening resulted in significantly increasing amounts of learning. Increases in learning appeared greater for literary materials than for science. Braille readers learned significantly more through repeated listening than did large type

readers when science materials were studied. However, for both types of material, the rates of increase in learning with repeated listening were greater for braille readers.

Such was not the case for elementary students who listened to literary and science material. Effects of repeated listening varied unsystematically from grade to grade and between the two types of readers. However, no significant differences were found among the varying amounts of practice. Consequently, it was concluded that for elementary level readers, listening two or three times consecutively failed to improve learning over that attained by listening once.

Consequently, while it appears that high school students derive considerable benefit from listening consecutively to material two or three times running, such is not the case for elementary level students.

3. Some Parameters of Learning by Listening--Part Three--The Relative Efficiency of Learning through Reading and Listening when Study Time is Held Constant (Morris & Nolan, 1970c)

Earlier research results (Nolan, 1966) showed that for literature and science materials, learning by blind students through listening was more efficient than that achieved through braille or large type reading. Listening efficiency was from 183-320% greater when amounts of learning per unit of time spent was the criterion. Combining the results of this research with those reported in Study 2 above enabled comparison of efficiency of learning through listening and reading when study time was held approximately constant. Eight comparisons were available for groups of braille and large type readers at both elementary and secondary levels who read or listened.

For both elementary and high school students, required reading time was double listening time with two exceptions. Reading times for braille students were triple listening times for both literature and science.

In five of the eight groups learning resulting from multiple consecutive listenings exceeded that resulting from one reading of the same material by 10% or more; however, in no group did the difference in the means for learning under the two conditions approach statistical significance. Therefore, it does not appear to matter, in terms of total study time, whether a student reads his material once or listens to it two or more times consecutively. In view of the findings in part one that consecutive listening may degrade learning performance of elementary students, a comparison of performance with distributed practice is of interest. Appropriate data are only available for the braille students. Analysis of these results indicated that elementary students, listening under distributed practice an equivalent time to that required for reading, do learn significantly more literature but no more science.

4. Some Parameters of Learning by Listening--Part Four--Learning through Listening when Practice is Massed and Distributed. (Morris & Nolan, 1970c)

In earlier listening research (Nolan, 1966), learning for literature and science through listening and reading was compared when visually handicapped elementary and high school students listened to materials for one day and on three consecutive days. Combining these results with those of Study 2 above allowed comparison of learning through listening when

students listened consecutively three times on one day with that achieved when they listened three times on consecutive days. Findings from the field of learning would lead to the prediction that listening practice distributed over a three day period would result in more learning.

This was the case for elementary level children. Listening once on each of three days yielded about 33% greater learning than continuous listening. These differences were statistically significant. However, such was not the case for high school students. Listening consecutively three times on one day produced a nonsignificant 12% more learning than when listening was distributed over three days.

5. Learning by Blind Children of Low Ability: The Relative Efficiency of Reading and Listening (Steele, 1971)

The study was designed to compare the relative comprehension of low IQ students for materials presented in braille and recorded form. The subjects were 80 blind students from five residential schools whose IQ's were 85 or less, who ranged in age from 9-20 years, and who had received braille instruction for at least 3 years. On the basis of a reading test, these students were divided into four groups of readers who possessed high reading rates--high comprehension, high rates--low comprehension, low rates--high comprehension, and low rates--low comprehension. The four groups were randomly divided so that half read materials in braille and half listened to the same materials. All subjects read or listened to two passages at the second and six grade reading level. Students read or listened to the materials only once and were tested for comprehension by a multiple-choice braille test immediately after. The general outcome of this study was that, for students whose reading comprehension was high, reading was the superior medium. For

students whose reading comprehension was low, listening was the superior medium.

6. Effect of Message Length and Frame of Reference Upon Learning (Brothers, 1971a)

Learning theorists have long considered the amount of material attempted and a prior frame of reference about what was to be learned significant factors in learning. To explore the relevance of these factors for listening through learning, 160 blind high school students divided into higher and lower groups according to mental ability listened to a recording of historical nature. Equal groups of students listened to the 24 minute recording when it was divided into 2, 3, 4, and 6 minute segments. Students took notes during the times between segments for periods designed so that total task time for all groups was equal. Prior to listening to their assigned segment length, one-half of the group heard a 1 minute summary of the total message while a control group heard a 1 minute message of non-specific information about the text. Analysis of the results revealed no significant effects due to variation of message length or presence or absence of a prior frame of reference as defined by the study.

7. Effects on Aural Learning of a Prior Frame of Reference (Morris, 1971)

Four studies of identical design were conducted in this area. They varied only in type of material used and educational level. These were intermediate social studies, intermediate science, high school social studies, and high school science. Grades comprising the intermediate groups were 6, 7, and 8. Grades comprising the high school groups were 9, 10, 11, and 12. The purpose of these studies was to follow up on work done by Brothers (1971a). Specifically, these studies concerned how prior frames of

reference affected aural learning. Evidence from the field of perception supports the expectation that a prior frame of reference should enhance learning.

In each study three experimental groups were used; one having no frame of reference, one using a general frame of reference, and the third using a very specific frame of reference. Other major effects under study were type of reading medium used (braille or large type) and grade level.

A total of 484 blind subjects was used in these studies. Results supported Brothers' findings in that no significant differences in learning resulted from prior use of a frame of reference, either general or specific, in any of the four studies. However, there was a trend for learning scores to increase as the specificity of the frame of reference increased for the social studies material at both levels. The only statistically significant finding from these four studies occurred at the high school level within the social studies condition where braille students learned more than large type students (.01 level) and where student learning was positively related to grade assignment (.05 level).

8. Effects of Message Length (Brothers, 1971b)

This was an investigation of message length and its effect on immediate and delayed recall. Forty blind high school students participated in the study. Six braille and four large type readers were assigned to each of four conditions. The conditions consisted of a 24 minute message, the same message divided into four segments of 6 minutes, three segments of 8 minutes, and two segments of 12 minutes in length. Following the presentation of each message segment, students responded to a series of questions

based on the part they had just heard. The measure of delayed recall was obtained using the same test after a period of 3 days.

The results supported earlier findings that segmenting the stimulus material in varied message length does not significantly affect comprehension or recall scores when the subjects have equal time to interact with the materials. Scores obtained immediately were significantly higher than those obtained 3 days later, but there was no evidence that message length conditions had any differential effects on comprehension for short or long delays. It was noted that braille readers scored significantly higher than large type readers under the delayed recall condition.

Development of an Aural Study System

The initial studies in this development involved a task analysis of study through listening and an intensive interview study of experienced users opinions about recorded textbook formats and aural study methods. Information derived from these projects was combined with that generated earlier (Nolan, 1966) to develop a set of specifications for the Aural Study System. The system was subsequently designed according to these specifications. Following design it was field tested. Finally, information developed throughout the project and earlier was used to write a study guide. Since all these reports have been published previously, they were only summarized here.

1. A Task Analysis (Morris & Nolan, 1970d)

In order to design an aural study system, a thorough understanding of the tasks involved in study through listening is necessary. To gain this knowledge, an analysis was made of the processes involved in studying from recorded textbooks. The books used were three previously recorded at the American Printing House in the Talking Book program and the equipment

used was an APH Talking Book Reproducer. The analysis resulted in identification of 24 distinct tasks involved in study from records. The steps necessary to complete each task were described in detail by identifying each necessary response, sequentially, along with the cue initiating it. This information was then used to help generate a tentative set of specifications for the design of playback equipment to be used in a study system.

2. Recorded Textbook Formats and Aural Study Methods: Summary of User Opinions (Morris & Nolan, 1970b)

Eighteen visually handicapped students at the University of Texas who were experienced users of auditory textbooks participated in each phase of this study.

Textbook Format: Three high school textbooks from the fields of literature, social studies, and science were analysed to identify their constituent parts. Lists of the 14 parts identified, along with a definition of each were reproduced in braille and large type. The lists were distributed to the blind subjects who were required to submit a written report giving a judgement of whether each book part would be more useful in written or recorded form and discussing their reasons for each judgement. The experimenters reviewed each report and explored any ambiguous points with each subject in an interview.

Eighty-three percent of the students preferred recorded texts with the exception of texts in mathematics, physical science, and certain languages which were more easily understood in written forms. With respect to parts of books, recorded forms were preferred for prefaces and/or forewords, acknowledgements, introductions, footnotes, and suggested activities while tables of contents, graphics, study questions, references, glossaries, and indexes were preferred in written form.

Aural Study Methods: All students were interviewed in depth on 19 questions related to study. Scheduling, understanding graphics, drowsiness, note-taking, place finding, and indexing were identified as critical areas in study through listening and methods for overcoming problems in these areas were suggested.

3. Description of the Aural Study System (Morris, Nolan, & Phelps, 1973)

Final specifications for the system were developed using all previous work as input. Printing House engineers developed an experimental model to fit the specifications. Development was intermittantly reviewed by the project staff as well as an outside panel of experts who were visually handicapped. When specifications were finally met to the satisfaction of the reviewers, development was terminated. The system as developed consists of a specially designed record format, a specially designed record player, and complementary written materials.

The specially designed record has two tracks recorded in each groove which can be played independently. One track (recorded at 66-2/3 rpm) contains index information and the second track (recorded at 8-1/3 rpm) contains the text of the recording. The recording on each record side can be divided into up to nine parts by narrow bands (.062 inch) which are blank. Information about the range of page numbers or letters of the alphabet recorded on each record can be listed on the record jacket.

The special record player has the following features: (a) forward and backward turntable action, (b) instantaneous turntable stop-start, (c) capability to play the two recorded tracks independently at the appropriate speeds, (d) a continuously variable playing speed control, (e) a tone arm having a retractable pickup cartridge incorporating a mechanism for

positively identifying the record edge and featuring stylus pressure light enough to prevent record damage through mishandling the tone arm, (f) a photoelectric cell in the tone arm that detects the unrecorded bands on the record and causes a tone to sound when the stylus is directly over the narrow empty band, and (g) a foot control for remote operation of the four modes--play, stop, fast reverse, and fast forward.

The complementary written materials consist of booklets, containing such things as a table of contents, lists of chapter titles and headings, spelling lists, study questions, graphics, and indexes.

To find a specific subject in a book, the user must first know the appropriate index term (page number or alphabetical listing) under which the item can be located. By entering appropriate lists, he can then identify the appropriate record and record side. Survey of braille or large type lists on or in the record jacket indicates the appropriate part of the record. The beginning of this part can be located by using the photoelectric cell in the tone arm to count the bands as the tone arm crosses them. The stylus can be placed on the appropriate band by maintaining the tone while the stylus is lowered through release of a lever. Engaging the fast forward control of the player switches to the index track of the record which is searched at 66-2/3 rpm. Once the index term is heard, disengaging the fast forward control instantaneously returns the equipment to regular play upon which the start of the material desired can be heard. Search within sections of material such as pages for specific facts is aided by increasing the rate of play with the variable speed control.

4. Field Trial of the Aural Study System (Morris, Nolan, & Brothers, 1973)

The equipment and materials of this system include a record player designed to be used for study, an especially designed stereophonic

record, a written key relating page number to record part, and a written supplement containing materials previously determined as not appropriate for aural presentation; namely, a table of contents, an outline of headings, spelling lists, study questions, references, bar graphs, a table, graphics, and an index. The written materials used in the field trial were in braille. The topic of the recording and its accompanying braille supplement was a unit of South American history taken from a world history book. Four record players were built for use in the field trial.

In the first phase of the field trial 36 blind students who read braille, ranging in grades from 5 through 12, were trained to use the various components of the system. Students spent one class period on four consecutive school days learning and practicing. On the fifth day they were tested. Of the 36 subjects, 35 performed at an acceptable level. Midway through this phase of the field trial an electrical circuitry problem was corrected in the players and the training procedure was modified as the students were learning more readily than anticipated.

Twenty-four high school level students who had been taught to use the system in the first phase of the field trial also participated in the second phase. Only high school students were used in this phase of the field trial as the content of the material was appropriate for students at this level. These students were given one class period of review and then spent three class periods (one per day) performing study tasks using the system. These tasks included locating and writing out short form answers to study questions, copying quotations verbatim, outlining, and summarizing. Although the quality of the written responses varied over a wide range, all students were able to use the Aural Study

System to perform these tasks with no particular problems being encountered. The data collected provides for a comparison of the time required to perform these study tasks using hand and foot controls.

Information acquired from the field trial has indicated where minor modifications in the Aural Study System would be desirable. Overall, the results were extremely positive.

5. Guide to Effective Study through Listening (Nolan, Brothers, & Morris, 1973)

This is a general guide to study through listening. Information in the guide was derived from interviews with visually impaired students who were experienced users of recorded texts, from research on listening, and from general "how to study" manuals. Topics covered in the manual include the role of listening in study, preparations for learning by listening, methods for study, and obtaining materials through local sources. The guide will eventually be distributed in recorded as well as written form.

Major Research Findings

Factors in Learning through Listening

1. As in previous research, a positive correlation was found between IQ and listening comprehension.

2. As in previous research, listening comprehension was found to increase with grade level.

3. As in previous research, braille readers often attained higher comprehension scores than large type readers. While some of this difference may be attributed to differences in mental ability between the groups, part probably results from the greater necessity of severely visually handicapped students to rely on listening as an information source.

4. Elementary level children showed no increase in learning scores when the number of successive presentation of auditory materials was varied from one through three. For high school students learning increased progressively and significantly with repeated successive listening. Limits of learning for these students did not seem to be attained after three presentations.

5. There was no significant difference in learning between reading and listening when study time was held approximately constant.

6. For elementary students exposed to three listening presentations, learning was superior for listening distributed over three days to that for listening massed in one day. High school students learned equally under massed and distributed conditions. Differences between length of attention span for the two grade level groups is probably responsible.

7. For low ability visually handicapped children, listening becomes a superior learning medium to braille only when braille reading comprehension is poor.

8. Segmenting a longer (24 minute) message into shorter segments for listening does not contribute to comprehension when total time on task is held constant. Neither is length of message segment related to delayed recall.

9. Presenting the listener with a general or specific summary of the message to be heard prior to listening does not enhance listening comprehension.

Development of an Aural Study System

1. The task analysis of study using books recorded on discs and played on a Talking Book reproducer identified 24 tasks. These could be divided into setup tasks, operational tasks, and study tasks. Setup tasks include identifying recorded material by its ink-print page numbers; finding proper record and side; setting up player; turning on player; adjusting tone, volume, and speed; and finding place on recording. Operational tasks include turning off player and removing pickup arm from discs, turning off player with pickup arm left in place, turning on player with pickup arm in place, pausing, moving pickup arm in fine gradients, changing discs, replaying a short section, speeding up play, slowing down play, skipping, and scanning rapidly. Study tasks included finding a topic in a recorded table of contents, finding a topic in a recorded index, searching for specific information in the text, taking notes, copying verbatim a recorded selection, learning new words, and interpreting verbal description of nonverbal ink-print graphics.

2. Eighty-three percent of 18 college students expressed a preference for text material in recorded form. Excepted were texts in mathematics, physical sciences, and language.

3. Students expressed clear preferences for textbook formats. Recorded forms were preferred for prefaces, forewords, acknowledgements, introductions, footnotes, suggested activities, and the text proper. Parts of the book preferred in printed form were those frequently used and included tables of contents, graphics, study questions, references, glossaries, and indexes.

4. With respect to study patterns and problems, students preferred concentrating on one subject at a time, listening only once, and taking notes. Subjects such as history and literature could be studied in mass fashion, while mathematics, science, and languages required distributed study. Reviewing notes was the primary method of text preparation. All students reported taking notes in summary, outline, or item form. Notes taken were either written or recorded. Passivity of the listening situation contributed to loss of attention and drowsiness. This was counteracted by engaging in activities which were directly or only marginally related to study purpose. Place finding was a severe problem in study.

5. The design of an Aural Study System was defined to include a special record, a special record player, and a special written supplement. Specifications for the recording included labels for sides, division of sides into parts by empty bands, stereophonic recording with a content track and index track, and calibration of index and content information. Specifications for the player included a power control; volume control;

tone control; speaker or headphone option; three turntable speeds; variable speed capability; forward-reverse turntable options; turntable instant pause; hand controls for fast forward, fast reverse, pause, and play turntable operations; foot control for the same; and a tone arm with retractable cartridge, a record edge finder, light stylus pressure, photoelectric sensor to detect blank bands in the record, and capability to play stereophonic tracks independently. Features to be included in the written supplement were the title page, table of contents, ink-print text chapter headings and sub-headings, spelling lists, study questions, graphics, unit activities, references, and the index.

6. Of 30 separate operational tasks involved in use of the study system, 26 were accomplished successfully by 85% of the test group students from grades 5-12. No grade differences for successful performance were found.

7. With less than 4 hours training and practice, 30 of 32 students from grades 5-12 could find a specific topic within a 3 hour recording in 5.6 minutes on the average. With less than 1-hour additional practice for high school students, mean location time was reduced to 3.2 minutes.

8. High school students with less than 5 hours training successfully performed study tasks which included answering study questions, copying a statement verbatim, outlining a passage, and summarizing a passage.

Areas for Further Research

Factors in Learning through Listening

While the search for factors related to learning through listening in this project was not always fruitful, further exploration of some factors appears warranted. Such exploration could profit from experience gained in this project.

For example, the extent of the listening tasks studied may have been too short for factors such as message length to be relevant. Future research should concern tasks which are more lengthy as in study proper. The tasks analyses and interview materials help define these extents.

Since any given factor may contribute only a small portion of the total variation among samples of learning scores, it is important that the measures employed be highly sensitive, the tasks involved be highly study relevant, and samples studied be large enough to reveal small but significant differences arising from such factors.

Efforts should be made to assure that subjects who participate in such studies are experienced users who accept listening as a valid study means. This has not been controlled or manipulated specifically in earlier work.

Among factors possible for further study are message length, learning through repeated listening, massed and distributed practice, active participation in study to include mental review and note-taking in conjunction with control of message length, effects of peripheral activities used to combat drowsiness, combinations of numbers of listening exposures, and numbers of reviews of notes, amounts of overlearning, and effects of environmental "noise." These should be studied in combination

with levels of grades and mental ability. Subject matter should also be varied. When compressed speech equipment allowing immediate user control of rate is readily available, rate of play should become another variable.

Development of an Aural Study System

Future application of the Aural Study System in use should be made. A production model of the player should be designed and produced in limited numbers for more intensive examination of use of the system with standard text materials. This could be combined with study of some of the factors mentioned above. The system should be given compressed speech capability as soon as technically and economically feasible.

Reference applications of the Aural Study System should be explored. Its accurate indexing capability provides great potential in this direction. Among recorded references possible are an encyclopedia, English and foreign language dictionaries, and a thesaurus. Format options for these works should be carefully explored with the consumer population.

Findings from the Aural Study System should be applied to cassette and open reel tape systems where applicable as rapidly as possible. Of particular importance is application of concepts and techniques for indexing and rapid access.

Development of materials and techniques to teach students to study through listening should be accelerated. As more information concerning factors important in learning through listening becomes available, the study guide should be revised. Courses, workshops, and self-instructional programs for this purpose should be designed and upgraded as relevant information becomes available.

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